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Revision 4.0

FINAL
SITE INSPECTION
OLIN CORPORATION SITE
HAMDEN, CONNECTICUT

TDD NO. F1-8305-04
NUS JOB NO. 3408
EPA SITE NO.
CONTRACT NO. 68-01-6699

FOR THE

REGION I
US EPA
SITE RESPONSE SECTION

JANUARY 15, 1985

NUS CORPORATION
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NOTICE

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EXECUTIVE SUMMARY

The Olin site is located in the town of Hamden, Connecticut, and is situated on a 102.8 acre piece of land. Leeder Hill Drive and Treadwell Street border the site on the east and north, respectively while the Penn Central railroad tracks border the site on the west. The site contains five interconnected ponds. Lake Whitney, a drinking water supply is situated across the street from the northern border of the site.

Olin (Winchester Repeating Arms Division) used the site as a gun powder and ammunition storage area from around the beginning of the twentieth century until 1973. The Hamden Health Department observed rubbish and chemical (spent solvents) disposal and the burning of combustible material at the site in March 1966. Although Olin removed most of the waste following an order by the town of Hamden in March 1966, the state became concerned about the site when Olin, in a 1979 report to the Congressional Subcommittee on Oversight and Investigation of Chemical Waste Disposal, acknowledged disposal, incineration and possible burial of industrial wastes that included various categories of chemicals such as organics, inorganics including heavy metals and trace metals, and highly volatile acids. Olin subsequently contracted Environmental Research and Technology, Inc. of Concord, Massachusetts, to conduct an investigation of the environmental effects of past disposal activities.

The site is characterized by prominent hills and ridges, swampy lowlands and valleys containing five interconnected ponds. The surficial geology of this area includes both stratified drift and till, with the till being restricted mainly to regions of higher elevations around the site. The ponds on the site are discharge points for local groundwater, which flows to them from the surrounding highlands. Lake Whitney is the largest and most significant surface water receptor downgradient of the site, while wells (industrial and residential) that surround the site are possible groundwater receptors.

On May 15 and 16, 1984, the NUS Corporation Field Investigation Team (NUS/FIT) sampled former disposal areas, on and off-site groundwater and on- and off-site surface water. Volatile organics, extractable organics and inorganics were detected in on- and off-site surface and groundwater and in the soil of the former disposal areas.

The NUS Region I FIT recommends the following actions:

- Installation of borings or monitoring wells upgradient of the H.A. Leed well to determine the source of the volatile organic contaminants.

- Quarterly sampling and priority pollutant analysis on groundwater from ERT well No. 7 and surface water from Pond D to indicate whether contaminants are migrating off-site.

- Further investigation of the area on the Anixter property where excavation took place in April to determine if contamination is present and if so, to find its extent.

- Possible soil removal from the areas where soil samples were obtained should be evaluated.

1.0 INTRODUCTION

1.1 Summary of NUS/FIT Involvement

The NUS Field Investigation Team (NUS/FIT) was tasked by the Region I U.S. Environmental Protection Agency (EPA), MA/CT/VT Site Response Section under Technical Directive Document (TDD) No. F1-8305-04 to conduct a site inspection at the Olin Site in Hamden, Connecticut (Appendix A). This was initiated after a preliminary assessment conducted by NUS/FIT recommended that a site inspection was necessary to define the severity of on-site contamination and the extent of its migration. Sampling for the site inspection was performed on May 15 and 16, 1984, and included groundwater, surface water and soil sampling.

1.2 Purpose/Objective

The purpose of the site inspection was to confirm the existence or absence of hazardous waste contamination at the site and to evaluate the likelihood of waste migration and the potential impact to the environment and surrounding population.

The objective of this evaluation is to ascertain the site's potential impact to human health and the environment by collecting samples, analyzing for organic and inorganic priority pollutants, evaluating the analytical data, and reviewing likely hydrogeologic pathways and receptors.

2.0 SITE DESCRIPTION

2.1 Site Location and Boundaries

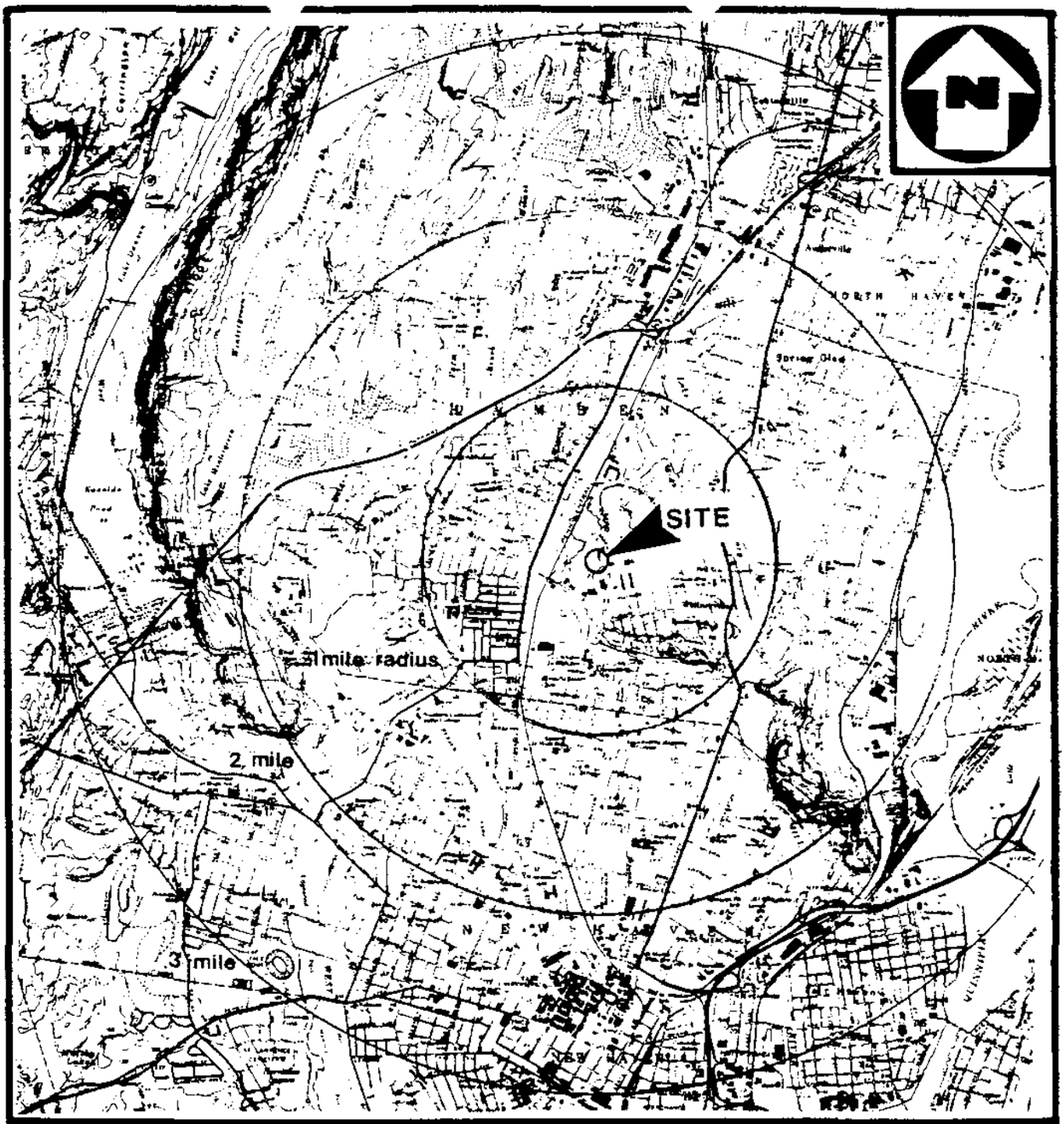
The Olin site is located on a 102.8 acre wooded parcel of land in the town of Hamden, Connecticut (41° 20' 52" north latitude and 72° 55' 30" west longitude)(Figure 1). Leeder Hill Drive and Treadwell Street border the site on the east and north, respectively. The Penn Central Railroad tracks border the site on the west and light industry along Putnam Avenue borders the site on the south (1). Buildings which border the site include the Southern New England Telephone Company and Whitney Retirement Home on the east and the H.A. Leed Company, Anixter Company, Capitol Tire, and Davenport Photo on the south (2).

The 102.8 acres of land that contains the site is wooded and contains no buildings. The former disposal and burning areas used by Olin are located on the southern portion of the site and are shown in Figure 2. Narrow paved and unpaved roads circle and traverse the site. The site is enclosed by a chain link fence and the only access is a gate off of Putnam Avenue (2).

2.2 Topography and Surface Drainage

The site is characterized by prominent hills and ridges, swampy lowlands and valleys containing five interconnected ponds. On-site surface water consists of the five ponds, a stream flowing into Pond A from a swamp south of the site, Pine Swamp south of Pond A and a stream flowing out of Pond E at the north end of the site (Figure 3). Off-site surface water consists of Lake Whitney north and east of the site, Quinnipiac River east of the site, Mill River southeast and north of the site, Beaver Pond south of the site and a swamp immediately south of the site (Figure 3). The average slope of the site is one percent (1).

A number of topographic features in the area are the result of man-made modifications of the landscape. Lake Whitney is one of several lakes and reservoirs created by dams. Small areas of artificial fill are present throughout the site; these include the causeways on the Pine Swamp tract, believed to have been built sometime prior to 1916 (3, 4, 5). Several gravel pits are present north of the site (3, 4).



BASE MAP IS A PORTION OF THE U.S.G.S. MOUNT CARMEL & NEW HAVEN, CONN. QUADRANGLE [7.5' SERIES, 1967, PHOTOREVISED 1972]

LOCUS PLAN

OLIN SITE

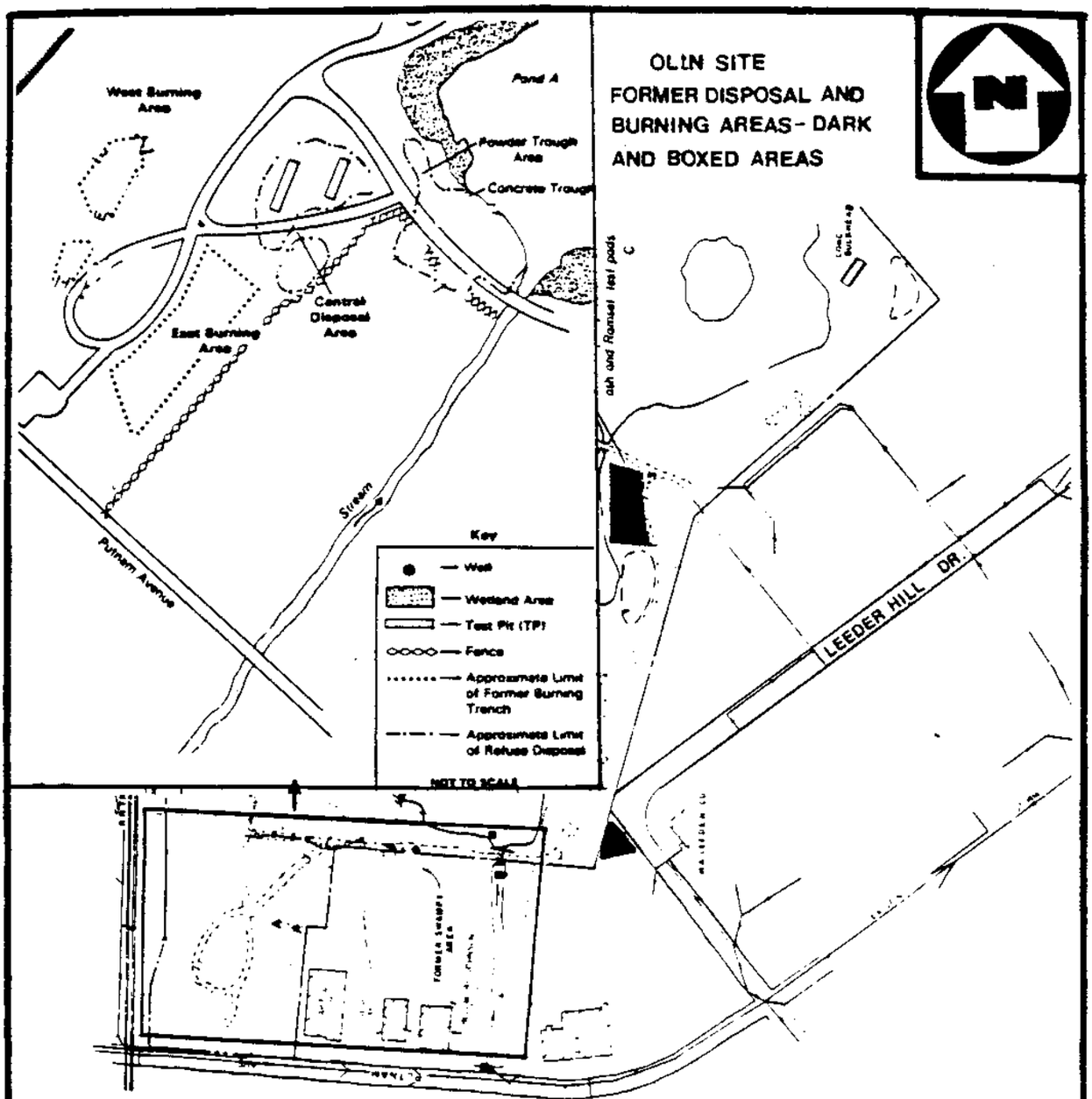
HAMDEN, CONNECTICUT

JUNE 1984

NUS CORPORATION

A Halliburton Company

FIGURE 1



NOTE: BOXED MAP TAKEN FROM
ERT PHASE II INVESTIGATION
REPORT (JUNE 1982)

FORMER DISPOSAL AREAS
(BLACK AREAS AND BOXED MAP)
OLIN CORPORATION SITE
HAMDEN, CT

JULY 1984

NUS CORPORATION
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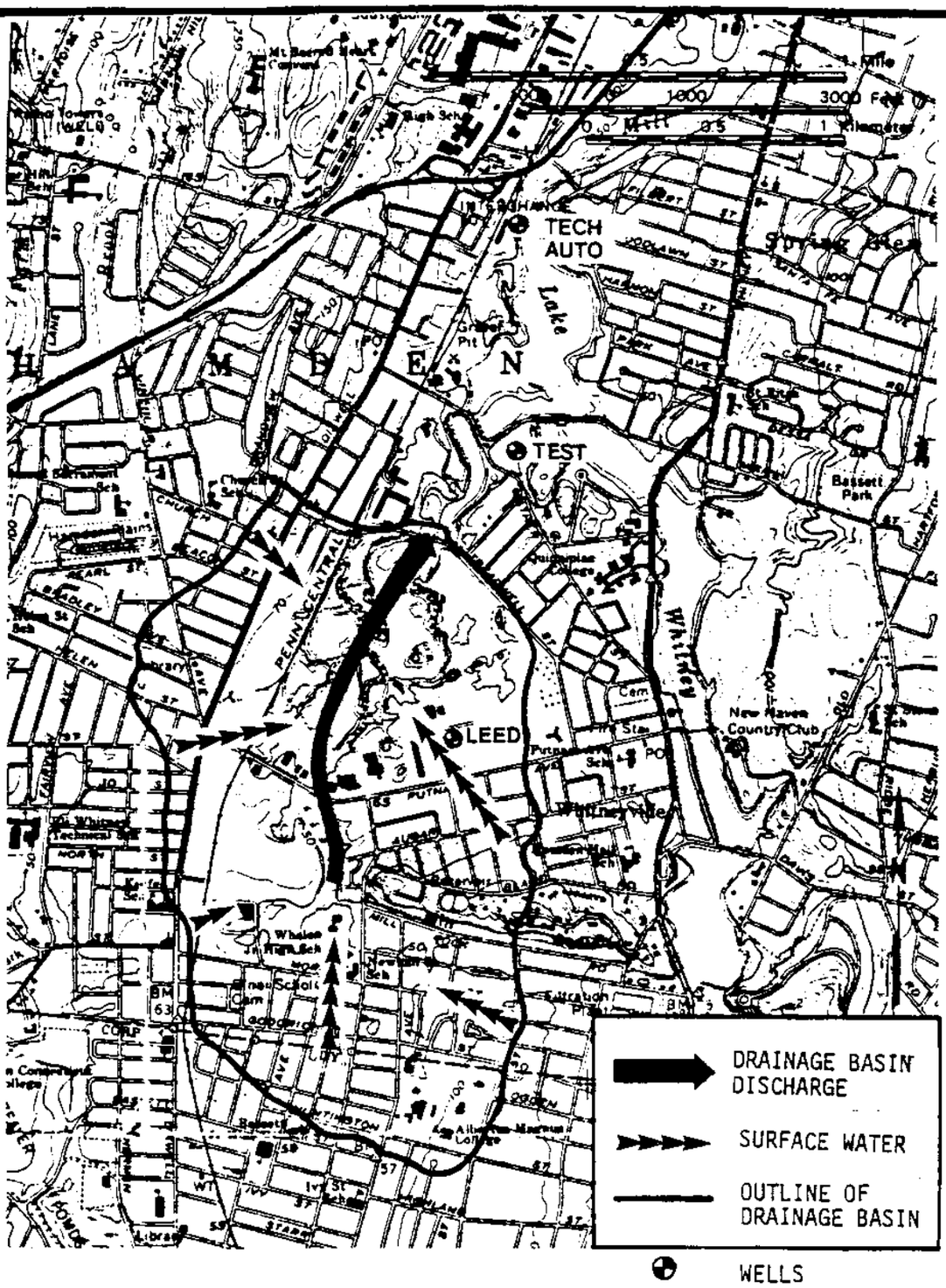
FIGURE 2



GENERALIZED SURFACE & GROUNDWATER FLOW DIRECTIONS
OLIN SITE
NEW HAVEN, CONNECTICUT
JULY 1984

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FIGURE 3

Surface drainage on the site is south-to-north as an unnamed stream flows into the site at Pond A and another stream flows out of the site from Pond E into Lake Whitney which is north of the site (6). However, regional drainage is generally north-to-south, paralleling the structural trends in the bedrock (3). The channels of the rivers and streams in the region are thought to have been slightly diverted as a result of regional glaciation (3). A number of ponds and swampy areas in the project region (including those on the Pine Swamp tract) occupy shallow basins (kettles) formed by the melting of residual blocks of glacial ice that had been buried in the glacial deposits (3). The kettles on the Pine Swamp property are part of the chain of kettles that extends southward into the New Haven area. Several of these kettles have been filled in since the time they were mapped (3).

2.3 Demography and Land Use

Densely populated communities are located near the site. Approximately 30,000 people reside within a one mile radius of the site which encompasses portions of the town of Hamden and the city of New Haven. There are approximately 94,000 people living within a two mile radius including the towns of Hamden, North Haven, and the city of New Haven. The towns of Hamden, North Haven, Woodbridge, and the city of New Haven are contained within a three mile radius where approximately 153,000 reside (7).

The site is currently inactive and consists of unoccupied land. Land use in the area varies widely. Industrial buildings border the site on south and west, a nursing home abuts the eastern border of the site, and Lake Whitney is located across the street on the northern border of the site. Agricultural land consisting of a vegetable farm owned by the Dadio family is situated across the street on the southern border of the site (7).

2.4 Climatology

The Hamden area receives an average yearly rainfall of 46 inches with a maximum expected rainfall of 3.0 inches in any one 24-hour period. The average yearly

surface and groundwater runoff is 24 inches, and the evapotranspiration rate is 28 inches per year (8, 9). The general wind direction is from the southwest and the average yearly temperature is approximately 59.9 degrees Fahrenheit (10).

2.5 Geohydrology

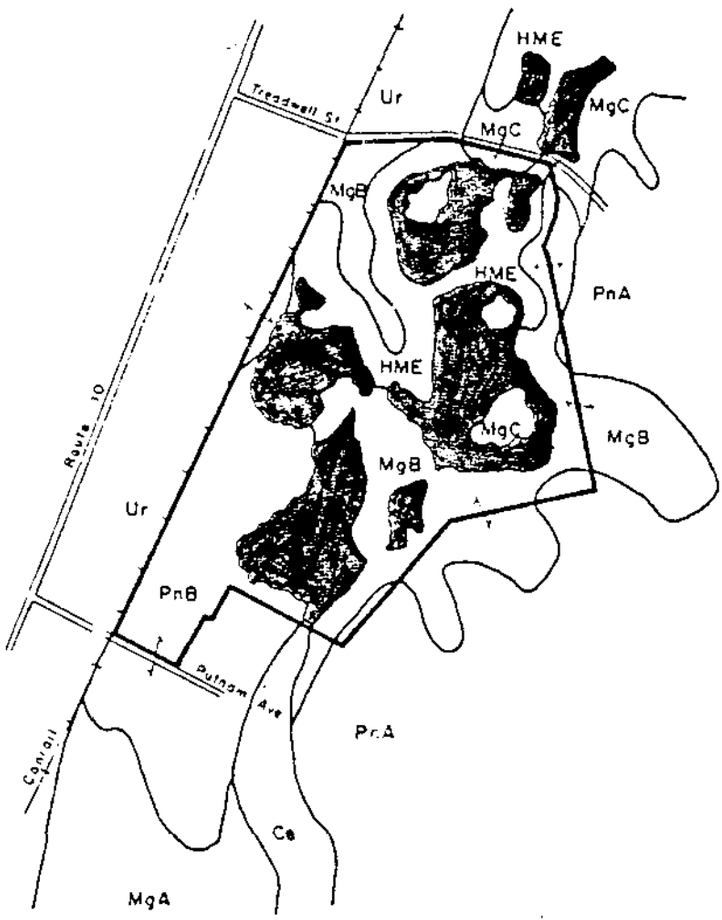
The surficial geology of this area includes both stratified drift and till, with the till being restricted mainly to regions of higher elevation around the site. The low-lying areas, including the Pine Swamp Property, are underlain by deposits of stratified sand, silt, and gravel, which may be as thick as 250 feet in the southern and eastern portions of the site. These stratified materials are primarily ice-contact deposits, and therefore exhibit typical glacial environment features such as kettle holes, kettle ponds, and kames (3, 11). In addition, small bodies of bouldery till may exist sporadically throughout the stratified drift.

Six borings drilled to depths of 35 to 50 feet on the Pine Swamp property in 1974 by Site Engineers, Inc. indicated that the stratified material in this area is generally composed of reddish-brown, fine to medium sand and gravel, with at least one body of reddish-brown sandy silt (12). The soils on this site are excessively drained and highly permeable, with pH's ranging from neutral to strongly acidic (Figure 4, Table 1).

The water table in the Pine Swamp area ranges in depth from 0 to 35 feet, and may vary considerably with the seasons (3, 12, 13). The kettle ponds in this location are apparently discharge points for local groundwater, which flows to them from the surrounding highlands (12, 14). The connection of these ponds with a local groundwater discharge area in the central part of the site is indicated by the fact that no surface water elevation gradient exists between them.

The deposits of stratified drift in this area constitute a significant regional aquifer, supplying water to local industries and residences (3, 15). Yields of wells screened in this aquifer vary widely according to saturated thickness, transmissivity, and storativity, with the highest yields being approximately 2000 gallons per minute (gpm), and the average yield being about 500 gpm (16). Many wells exist on and

SOILS MAP



NOTE: FROM ERT PHASE II INVESTIGATION REPORT JUNE 1982

SCALE: 1" = 1000'

0 1/4 1/2 mile

0 1000' 2000' 3000'

WATER

ADAPTED FROM NEW HAVEN COUNTY SOIL SURVEY, U.S.D.A. - S.C.S.

OLIN CORPORATION SITE
HAMDEN, CT

JULY 1984

NUS CORPORATION
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FIGURE 4

TABLE 1

CHARACTERISTICS OF SOILS PRESENT ON THE
PINE SWAMP PROPERTY

MAP SYMBOL	SOIL NAME	PERMEABILITY	RATE OF RUNOFF	AVAIL. WATER CAPACITY	DEGREE OF DRAINAGE	SOIL pH
PnA	Penwood loamy sand, 0-3 % slopes	rapid	slow	low	excessive	slightly acid to very strongly acid
PnB	Penwood loamy sand, 3-8 % slopes	rapid	slow	low	excessive	slightly acid to very strongly acid
MgB	Manchester gravelly sandy loam, 3-8 % slopes	rapid to very rapid(1)	slow	low	excessive	---
MgC	Manchester gravelly sandy loam, 8-15 % slopes	rapid to very rapid(1)	slow	low	excessive	---
Ce	Carlisle Muck	moderately rapid	very slow	high	very poor	medium acid to neutral
HME	Hinckley and Manchester (terrace escarpments), 15-35 % slope	rapid to very rapid(1)	rapid	low	excessive	---
Ur	Urban land (2)	---	---	---	---	---

Note: From ERT Phase I Investigation Report of the Olin site (January 1981).

(1) rapid permeability in the surface layer and subsoil; very rapid permeability in the substratum.

(2) consists mainly of areas covered by buildings, paved roads and parking lots. Requires on-site investigation to determine engineering properties.

SOURCE: USDA SCS 1979.

around this site. The on-site wells were installed by a subcontractor to Environmental Research and Technology (ERT), a consulting firm hired by Olin to conduct a hydrogeologic investigation of the site. All wells installed during the ERT investigation were not advanced to underlying bedrock because of its excessive depth (32).

Groundwater wells that surround the site include the Dadio well south of the site, industrial wells at the H.A. Leed Company, southeast of the site and the Himmel Brothers Company west of the site, a New Haven Water Company test well northeast of the site, and a drinking water well located 1.3 miles north of the site at the Tech Auto Body Shop. All wells were completed in the stratified drift with the Leed well being the deepest at 192 feet. The New Haven Water Company test well and the Tech Auto Body Shop well are possible downgradient wells with the former being most likely to be affected because of its depth (100 ft) and proximity to the site. It is possible that the New Haven Water Company test well could draw contaminated groundwater when in use. This could also be true of the H.A. Leed well because of its depth (7).

2.6 Water Supply

Lake Whitney is the major water supply for the town of Hamden and for parts of New Haven. According to the New Haven Water Company, two private drinking water wells are known to exist in the vicinity of the site. The nearest well is located south of the site at the Dadio residence on the south side of Putnam Avenue and it serves the Dadio family. The other well is located approximately 1.3 miles north of the site at Tech Auto, Inc. which is along the west bank of Lake Whitney. This well serves approximately 25 people (7).

3.0 SITE HISTORY/ACTIVITY

3.1 Ownership History

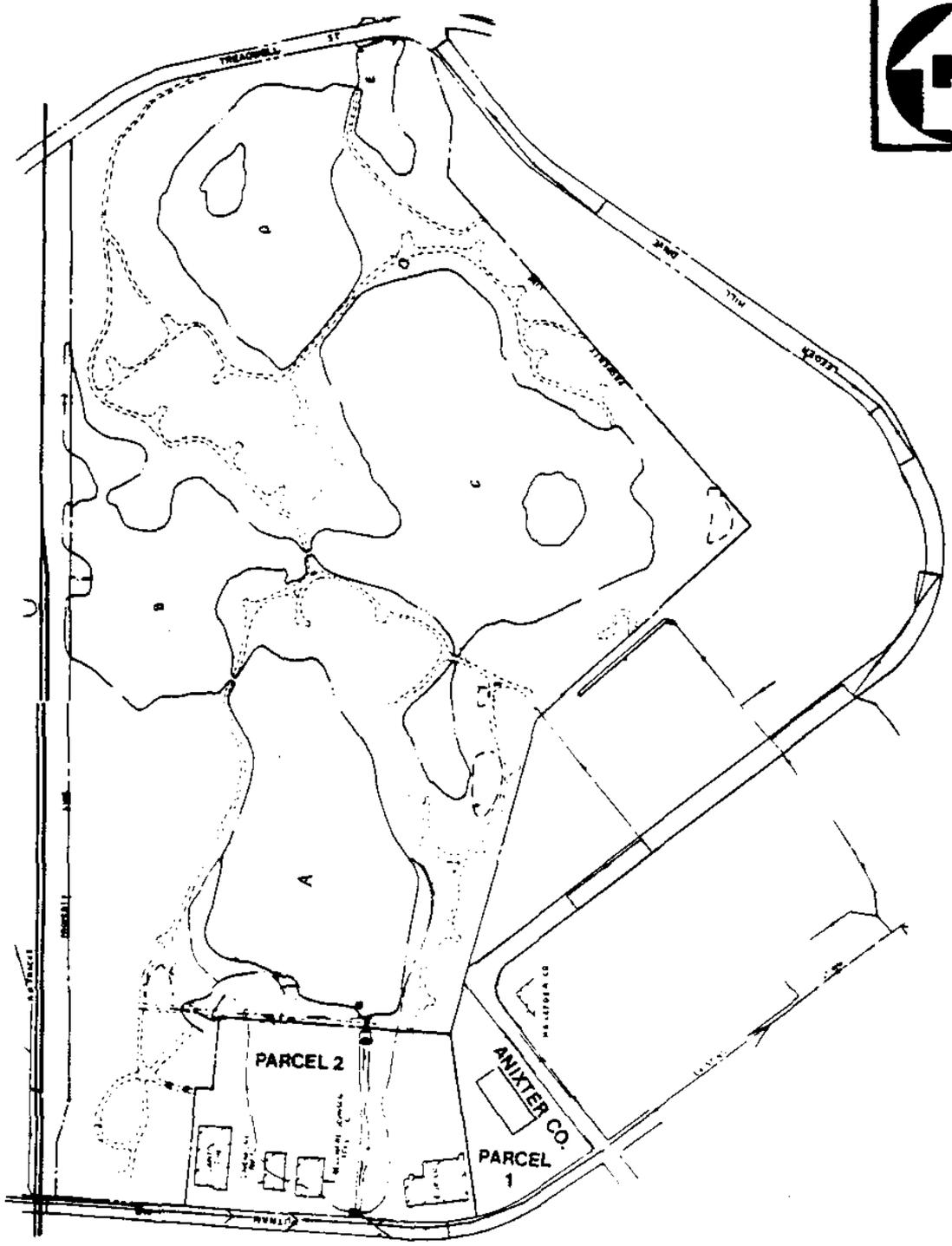
The Olin Corporation is the current owner of the site. Olin acquired the land sometime between 1889 and 1915 (17). In 1964, Olin sold a parcel of land that abutts the site (parcel 1 in Figure 5) to County Enterprises who in turn sold the land to the Anixter Company. Anixter currently maintains a building on that parcel of land. The U.I. Company has owned parcel 2 in Figure 5 since 1927 and Capitol Tire and Davenport Photo are the current tenants on this parcel (18).

3.2 Site History

Olin (Winchester Repeating Arms Division) used the site (property currently owned by Olin) as a gun powder and ammunition storage area from the time they acquired the property until 1973. Olin also test fired their ammunition at the site. Approximately thirty-five bunkers were located around the site to store gun powder an ammunition. The bunkers were removed in 1973 (17).

In February 1966, the Hamden Health Department received a complaint from a private citizen that dumping and burning of chemical waste (spent solvents) was occurring in the area of Putnam Avenue and Dixwell Avenue in Hamden. Claims were made that this burning generated odors and smoke that were offensive to the residents and businesses in the immediate vicinity. The Hamden Health Department investigated this complaint on March 15, 1966 and confirmed that burning was occurring on the Olin property. They observed truck loads of chemical material (bottles of spent solvents) and rubbish being transported from Olin's New Haven plant to the Olin site in Hamden for disposal (19).

A hearing was held on March 23, 1966 in the office of the Hamden Health Department to discuss the disposal and burning problem (20). Those in attendance included representatives from the Hamden Health Department, the Hamden Fire Department, and the New Haven Water Company. A representative of the Hamden



PROPERTY BOUNDARIES
OLIN CORPORATION SITE
HAMDEN, CT

JULY 1984

NUS CORPORATION
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FIGURE 5

Health Department stated that chemicals of all kinds were contained in bottles and found in shallow pits. A representative of Olin explained that these bottles were fired at from a distance to dissipate the chemical contents. At the conclusion of the meeting, the Hamden Health Department directed Olin to cease transporting materials to Hamden as of March 23, 1966, to cease burning of combustible material onsite by March 26, 1966, and to remove all non-combustible debris by April 6, 1966 (20).

The Hamden Health Department performed follow-up inspections on April 7, and June 3, 1966. They made the following observations during these inspections.

- All of the chemical waste had been removed.
- The pits that were used for refuse and burning were backfilled with clean fill.

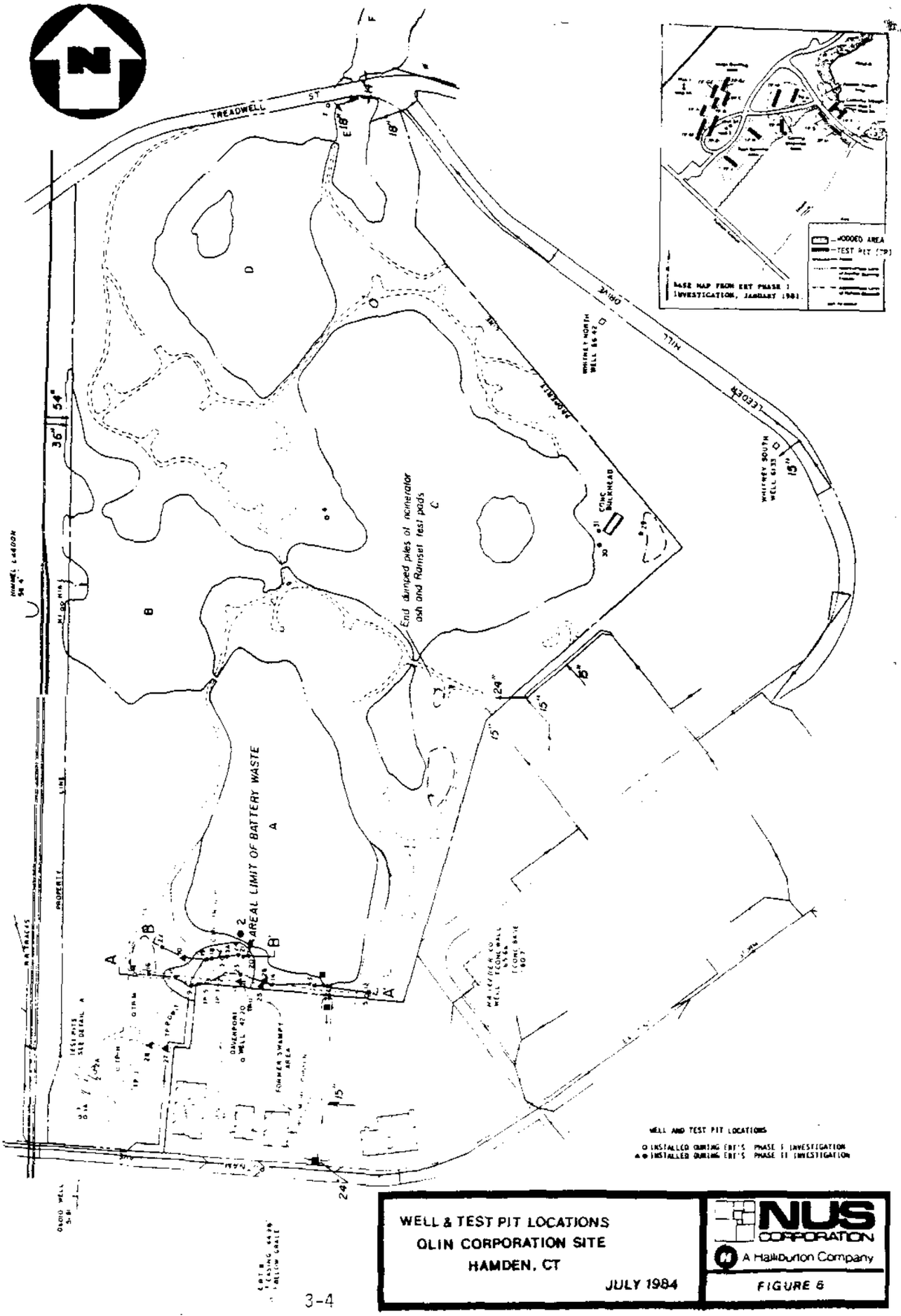
Olin stated that no more dumping and burning would occur (21).

In a 1979 report to the Congressional Subcommittee on Oversight and Investigation of Chemical Waste Disposal, Olin acknowledged disposal, incineration, and possible burial of industrial wastes that included various categories of chemicals such as organics, inorganics including heavy and trace metals, and highly volatile acids (22).

Early in 1980, Olin contracted Environmental Research and Technology, Inc. (ERT) to conduct an investigation of the environmental effects of past disposal activities. This investigation was conducted to support the transfer of property to the town of Hamden for use as recreational/open space. Their study included:

- Investigation of surface and groundwater hydrology of the area.

- Excavation of test pits in the disposal areas to ascertain what types of materials were buried (Figure 6).



WELL & TEST PIT LOCATIONS
OLIN CORPORATION SITE
HAMDEN, CT
JULY 1984

NUS CORPORATION
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FIGURE 6

- Installation of observation wells at 12 locations on the site (Figure 6) to establish groundwater conditions.

- Sampling and analysis of groundwater, surface water and sediment.

ERT presented a report to Olin in January 1981, and Olin volunteered the report to the Connecticut DEP (23). The results of the report are discussed in section 4.1.

After reveiwing the ERT Report and after receiving comments about it from the New Haven Water Company, the Connecticut DEP sent a letter to Olin on May 26, 1981, that requested a meeting to discuss several issues including:

- That the placement of well screens may have been inappropriate given the vertical component of groundwater flow at the site.

- That materials encountered in test pit excavation which exhibited a chemical or oily odor had not been identified.

- That effects of precipitation resulting in leaching of materials buried above the water table had not been evaluated.

- That recommendations should be made regarding possible off-site removal of residual materials.

- That the area covered by test pit excavation did not fully encompass all suspect source areas (24).

Two subsequent meetings were held at the Connecticut DEP to discuss the quesions raised by the ERT report. Representatives of the DEP, ERT, Olin, and the New Haven Water Company were present at the August 3, and October 23, 1981 meetings. After a discussion of the ERT report in the first meeting, the DEP informed Olin that it would issue a State Pollution Abatement Order requiring the removal of buried batteries and associated soil that constituted a significant

inorganic contamination to the ground and surface water (25). At the second meeting, Olin provided an alternative plan which included installation of additional wells at appropriate depths and locations to intercept contamination from battery disposal sites, drilling of more borings to try to define the extent of the battery disposal area, and the performance of EP-toxicity tests and analysis for manganese, zinc, chromium, mercury, cadmium and lead on a subset of samples (26).

On December 1, 1981, Olin sent a letter to the Connecticut DEP finalizing plans for further investigation to be conducted by ERT. In addition to the above mentioned intentions, Olin also agreed to conduct further sampling of some previously installed ERT wells (27).

ERT performed Phase II of their investigation from December 7-22, 1981. Representatives from Olin, ERT, the Connecticut DEP, and the New Haven Water Company were present during various periods of the investigation. The investigation consisted of installation of additional borings (a total of 23) and wells (a total of 17) which are shown in Figure 5 and sampling of groundwater, surface water, soil (from former disposal areas), and sediment (from the ponds)(28). ERT presented a report to Olin in June 1982 that showed contamination in the soil, groundwater, and surface water and also stated that groundwater was contaminated with volatile organic compounds before entering the site (i.e. from off-site sources).

The Connecticut DEP collected and analyzed samples from on and off-site locations in 1981 and 1982. On and off-site groundwater samples were collected from November 1981 to April 1982. In August 1982, two soil samples were collected from an area approximately 50 yards upgradient of ERT well no. 5 on property owned by the Anixter Company in response to the ERT Phase II investigation report that the groundwater was contaminated with volatile organics before entering the site (29, 30).

The Connecticut DEP confirmed the presence of volatile organic contamination and used this evidence to issue an abatement order to the Anixter company on January 1, 1984 to remove the contaminated soil. Fuss and O'Neil were contracted to perform the work described in the abatement order. A subcontractor to Fuss and O'Neil began removing soil on April 2, 1984. After this subcontractor encountered volatile organic contaminants and other debris down to depths of approximately 25 feet, the Connecticut DEP decided to install two monitoring wells to intercept the contaminated groundwater before it moved onto the site and to fill the area where soil was excavated with clean fill (31).

4.0 WASTE TYPES AND QUANTITIES

4.1 Wastes Present and Quantities

The disposal history of the Olin site is presented in section 3.2 of this report. Although Olin removed the majority of the waste and refuse within two weeks after their meeting with the town of Hamden, other waste remains on the site. ERT's Phase I investigation of the site identified four disposal and/or burning areas (Figure 2). Excavation of test pits indicated that two small areas had been used predominantly for burning scrap wood (referred to as the east and west burning areas). These areas also contained minor amounts of battery waste, scrap metal and glass bottles. The central disposal area appeared to have been used solely for burial of building demolition rubble. A fourth area, at the southern end of Pond A, contained battery waste, demolition rubble, domestic waste, and miscellaneous debris from the New Haven Winchester plant (32). ERT's Phase II investigation revealed another disposal area to the southwest of Pond C that contained primarily incinerator ash, demolition debris, domestic type refuse and ramset (concrete) test pads. It is not known how much waste material was originally contained or now remains on the site, but Olin estimates that at least 3500 cubic yards of waste containing the remains of flashlight batteries underlie the site in the disposal area near Pond A (30). These remains were the only evidence of on-site waste observed by the NUS/FIT during the site visit and site inspection.

Analytical data for soil, sediment, groundwater, and surface water samples were obtained by ERT during their two site investigations, while the state of Connecticut obtained analytical data for groundwater from November 1981 to April 1982 and soil in August 1982. ERT's Phase I Investigation analytical results are listed in Appendix B, Phase II analytical results are listed in Appendix C and the state of Connecticut's analytical results are listed in Appendix D (29, 30, 33).

All data was evaluated with regard to the detection limit of each compound and therefore all comments that appear when reporting the data are made in reference to this fact i.e. slightly or significantly above detection limits.

ERT's Phase I Investigation of the Olin site detected organic contamination in on- and off-site groundwater and on-site sediments, and inorganic contamination in on-site groundwater and sediments. Bis(2-ethylhexyl)phthalate was detected in the off-site Himmel well (25 ppb), and two on-site wells (3 and 20 ppb), while di-n-butyl phthalate was detected in one on-site well (25 ppb). Methylene chloride was detected in three on-site wells (8-14 ppb), while the off-site H.A. Leed well and the on-site ERT well immediately downgradient (ERT-5) contained a variety of volatile organic compounds with ERT-5 containing levels of TCE (500 ppb), 1,2-trans-dichloroethylene (710 ppb) and tetrachloroethylene (2400 ppb) significantly above detection limits. A number of extractable organic compounds, and one volatile organic compound (methylene chloride) were detected in the sediment of Pond A, Pond B, and Pond E. Manganese and zinc were found in levels slightly above detection limits in the groundwater near the southern end of Pond A. Lead was detected (70-750 ppb) in the sediments of all the ponds.

ERT's Phase II Investigation detected organic contamination in on- and off-site wells and inorganic contamination in on-site wells. Fluoranthene was the only extractable organic compound detected and that was in one on-site ERT well (22 ppb). Volatile organic analysis detected 1,1-dichloroethylene in two on-site wells (20 ppb), trans-1,2-dichloroethylene in two on-site wells (10-70 ppb), tetrachloroethylene in one on-site well (14 ppb), trichloroethylene in one on-site well (58 ppb) and toluene in one on-site well (39 ppb).

Non-priority pollutant volatile organic compounds detected included acetone in three on-site wells (200-570 ppb), tetrahydrofuran in eight on-site wells (30-1,300 ppb) and the off-site Davenport Photo well (45 ppb), ethyl ether in one on-site well (300 ppb), and tertiary-butyl alcohol in four on-site wells (350-5300 ppb) the Davenport Photo well (890 ppb). Inorganic contamination detected included manganese in seven on-site wells (2,900-21,000 ppb) and zinc in three on-site wells (1,200-6,900 ppb). The EP-toxicity test was performed for on-site monitoring well core (split spoon) samples, and lead was found above detection limit levels in one sample and zinc found above detection limit levels in five samples.

The state of Connecticut detected volatile organic contaminants in nine on-site ERT wells and the off-site Davenport Photo well with the most contaminants and highest concentrations occurring in ERT-5, ERT-12, and ERT-29. Analysis of the soil on the Anixter property that borders the Olin site and Leeder Hill Drive also detected a number of volatile organic contaminants. Inorganic analysis of on-site groundwater detected lead in three on-site wells (280-940 ppb), zinc in two on-site wells (460-490 ppb), and manganese in two on-site wells (8,000-12,000 ppb).

4.2 Waste Disposition

In order to prepare for the site inspection, the NUS/FIT performed a site visit on April 6, 1984 to observe locations of former waste disposal areas (that possibly contained buried waste) and groundwater monitoring wells. The visit consisted of viewing the site with Paul Duff, the manager of Olin's Energy and Environmental Affairs. The following observations were made:

- A fenced access road off of Putnam Avenue provided the only access to the site.
- Five ponds existed on the site.
- Wildlife (swans) and recreational activities (fishing) were observed.
- The only visible disposal area was located on the south shore of Pond A. Battery remains were scattered on the ground.
- While walking past ERT well No. 5, an excavation was observed approximately 50 yards upgradient on property owned by the Anixter company. The excavated pit was approximately 25 feet deep and while NUS/FIT observed the excavation, one of the excavators stated that there was a chemical odor in the pit.

During the site visit, Paul Duff volunteered the following information about the site. Bunkers, located all around the site, were used to house gun powder and

ammunitions. Test firing of the ammunition was performed on the site. In addition, Paul Duff stated that the only waste that he considered to be a possible hazard was the battery waste. The only visible signs of the waste was remains of old batteries scattered on the ground near ERT wells 3 and 3A (32).

4.3 Receptors

Most of the burning and disposal areas are located south and upgradient of Pond A which is the point of discharge for groundwater flowing through the previous disposal areas. There is a perched groundwater mound underlying the battery waste disposal area (30). It is perched on top of fine-grained sediments composed of fine sand, silt, and clay that underlie the waste. These sediments restrict vertical flow of shallow groundwater. The relatively rapid permeability of the stratified drift and the overlying soils may allow precipitation to leach contaminants from the battery waste into the perched groundwater which eventually discharges into Pond A (30).

Pond A is hydrologically linked to all the other ponds and surface water flows into Lake Whitney from the northern end of the site. Likewise, general groundwater flow patterns parallel the surface water (30). Lake Whitney serves as a major drinking water supply for the town of Hamden and part of New Haven. A drinking water well is located approximately 1.3 miles north (upgradient) of the site at Tech Auto, located along the west bank of Lake Whitney and it serves approximately 25 people (7)(30).

5.0 SITE INSPECTION

5.1 Logistics and Site Set-Up

On the day prior to this site inspection (5/14/84), a meeting was held for all personnel involved in the site inspection (John Panaro, Robert Palermo, Robert Ross, and Lawrence Fitzgerald). At this time, the site layout and command post location were discussed, as well as Quality Assurance/Quality Control needs, decontamination procedures, and possible hazards associated with the site.

Access to the site was obtained through Olin's Manager of Energy and Environmental Affairs, Paul Duff, prior to the inspection.

The command post was located approximately 50 yards from the gate at the entrance of the site off of Putnam Avenue, and the van was placed approximately 10 yards from the hotline. This area served as a departure point for the sampling team and as a location for sample equipment and personnel decontamination. Although previous air monitoring during the site visit did not detect ambient levels of organic vapors above background, monitoring was still conducted during the site inspection with an HNu photoionizer while collecting groundwater and soil samples. During the site inspection, no ambient levels above background were detected in the breathing zone (only in two on-site monitoring well casings).

5.2 Technical Approach

On May 15 and 16, 1983, the NUS/FIT performed a site inspection at the Olin Corporation site. The main objective of the site inspection was to obtain soil samples from areas of previous waste disposal; surface water samples from on-site ponds, exiting and entering streams, and Lake Whitney; and to obtain groundwater samples from on- and off-site wells for organic (Appendix E) and inorganic (Appendix F) priority pollutant analyses. A total of 28 samples were collected. Sample locations are listed in Table 2.

TABLE 2
SAMPLING POINTS
May 15 and 16, 1984

GROUNDWATER

Well	Date Sampled	Depth
Dadio	5/15	30'
ERT 1	5/15	64'8"
ERT 1A	5/15	42'
ERT 2	5/15	61'
ERT 2A	5/15	40'9"
Himmel	5/16	55'
Tech Auto	5/16	unknown
HI	5/15	20'
ERT 3	5/15	66'6"
ERT 3 Dup.	5/15	66'6"
ERT 3A	5/15	41'6"
ERT 13	5/16	6'
ERT 5	5/16	66'
ERT 12	5/16	13'5"
ERT 7	5/16	58'
H.A. Leeds	5/16	192' (in strat. drift)
Whitney Retirement Home (Northwell)	5/16	unknown

SURFACE WATER

Source	Date Sampled
Pond A	5/16
Pond B	5/16
Pond C	5/16
Pond D	5/16
Pond E	5/16
Lake Whitney (near Treadwell St.)	5/16
Stream before Pond A	5/16
Stream before bridge on Putnam Ave	5/16

SOIL

Source	Date Sampled
near ERT-3	5/16
near ERT-3 Dup.	5/16
near Pond C (south)	5/16

Soil samples were collected by digging beneath the soil surface (6-inches at S-1 and 12-inches at S-3) with a stainless steel trowel and placing the soil into a 16 ounce jar, 8 ounce jar and two 40 ml septum sealed vials. Surface water samples were collected by submerging the sample containers into the water near the edge of the body of water. The groundwater samples were collected from wells with a bailer after the well had been purged of three times the standing volume of water by a centrifugal or air driven pump. Each surface water and groundwater sample consisted of two 40 ml septum sealed vials, two half gallon glass bottles and one 1 liter polyethylene bottle. The site inspection was conducted in accordance with NUS/FIT Standard Operating Guideline No. 8 (groundwater sampling), No. 9 (surface water sampling), No. 10 (soil sampling), and No. 23 (decontamination procedures). An extra set of samples was collected at each sampling location (duplicates at soil locations and replicates at water locations) so that Olin was provided with split samples.

Ambient air characterization was conducted with an HNu Photoionizer while taking soil samples and before purging wells. Readings above background were detected at sample locations G-14 (2 ppm) and G-15 (0.5 ppm). These levels were detected in the well casing and not in the breathing zone.

Decontamination of sample containers and personal equipment involved an alconox and water wash followed by a water rinse. All on-site samples required decontamination. Water samples collected in 44 ml vials for volatile analysis were preserved with mercuric chloride to a final concentration of 15 ppm ($HgCl_2$). Water samples collected in one liter polyethylene bottles for metal analysis were preserved with HNO_3 to a final pH less than 2.0. All samples collected for organic analysis were packed in ice after collection.

The personnel and respiratory protection levels for sample collection were "C" for the soil and "D" for the surface and groundwater samples. Level "C" protection consisted of a tyvek coverall, rubber boots, surgical gloves and an ultra-twin respirator, while level "D" protection consisted of a tyvek coverall and rubber boots. An approved site safety plan was generated for the site inspection. Work conducted during the site inspection adhered to this safety plan.

5.3 Results

All of the samples were analyzed for the volatile organic priority pollutants (Appendix B), extractable organic priority pollutants (Appendix B), and the Task 1 and 2 inorganic priority pollutants (Appendix C). Based on previous groundwater, surface water, and soil analysis performed by ERT and the state, lead, magnesium, and zinc were the suspected metal contaminants in the former disposal areas while a variety of volatile organic compounds were the suspected organic contaminants. The samples were sent to two national contract laboratories as follows:

Water and Soils/Metal Analysis (Task 1 and 2 inorganics):
Rocky Mountain Analytical, Arvada, Colorado

Water and Soils/Organic Analysis:
Mead Compuchem, Chapel Hill, North Carolina

The analytical results are listed in Tables 1-9 and also are presented graphically in Figures 8-13. The following table lists the Figures and Tables of specific analytical results.

Volatile organic analyses of groundwater - Table 1, Figure 7
Volatile organic analyses of surface water - Table 4, Figure 9
Volatile organic analyses of soil - Table 7, Figure 11
Extractable organic analyses of groundwater - Table 2, Figure 7
Extractable organic analyses of surface water - Table 5, Figure 9
Extractable organic analyses of soil - Table 8, Figure 11
Inorganic (metal) analyses of groundwater - Table 3, Figure 8
Inorganic (metal) analyses of surface water - Table 6, Figure 10
Inorganic (metal) analyses of soil - Table 9, Figure 12

Previous analyses of samples from the site had shown lead, magnesium and zinc contamination at one of the former disposal areas near ERT monitoring wells numbered ERT-3 and ERT-3A and a variety of volatile organic contaminants in the groundwater from monitoring wells ERT-5 and ERT-12. Results from the analyses

TABLE 3

Volatile Organic Priority Pollutant Analyses of On and Off-Site Groundwater Samples Collected During the NUS Site Inspection of the Olin Site Inspection on May 15 and 16, 1984.

	ERT Well No. (concentration in ppb)											
Contaminant	Field Blank	1	1A	2	2A	3	3A	5	12	H1	13	H.A. Leed Well
1,2-dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.1
methylene chloride	ND	ND	ND	6.2	ND	ND	6.9	17	17	6.9	7.1	6.9
tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	140	300	ND	ND	190
trichlororethylene	ND	ND	ND	ND	ND	ND	ND	8	33	ND	ND	55
chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	56
1,1,1-trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	230
1,1-dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11
trans-1,2-dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23
1,2-dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
fluorotrichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	17

TABLE 3 (cont'd)

Volatile Organic Priority Pollutant Analyses of On and Off-Site Groundwater Samples Collected During the NUS Site Inspection of the Olin Site Inspection on May 15 and 16, 1984.

	ERT Well No. (concentration in ppb)					
Contaminant	Dadio Well	3 dup	7	Whitney Ctr. South Well	Himmel Well	Tech Auto Well
1,2-dichloroethane	ND	ND	ND	ND	ND	ND
methylene chloride	ND	ND	8.7	7.6*	720**	ND
tetrachloroethene	ND	ND	ND	ND	ND	ND
trichlororethylene	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
1,1,1-trichloroethene	ND	ND	ND	ND	ND	ND
1,1-dichloroethene	ND	ND	ND	ND	ND	ND
trans-1,2-dichloroethene	ND	ND	ND	ND	ND	ND
1,2-dichloropropane	ND	ND	ND	ND	ND	ND
fluorotrichloromethane	ND	ND	ND	ND	ND	ND

* - levels are approximate due to surrogate recoveries slightly out of QC limits.

** - surrogate recoveries were excessively low and the holding time was excessive. Therefore, this value should be considered approximate.

TABLE 4

Extractable Organic Priority Pollutant Analyses of On and Off-Site Groundwater Samples Collected During the NUS Site Inspection of the Olin Site Inspection on May 15 and 16, 1984.

	ERT Well No. (concentration in ppb)																	
Contaminant	Field Blank	1	1A	2	2A	3	3A	5	12	H1	13	H.A. Leed Well	Dadio Well	3 dup	7	Whitney Ctr. South Well	Himmel	Tech Auto
di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	110	ND	ND	ND
di-n-octyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	640	ND	21*	ND

* - levels are approximate due to surrogate recoveries slightly outside of QC limits.

TABLE 5
PRIORITY POLLUTANT INORGANIC ANALYSES OF ON AND OFF-SITE GROUNDWATER
OBTAINED DURING THE OLIN SITE INSPECTION PERFORMED BY NUS/FIT ON MAY 15 AND 16, 1984

PRIORITY POLLUTANT INORGANIC ELEMENTS								
Concentration in ppb (TASK 1)	Field Blank	ERT-1A	ERT-2	ERT-2A	ERT-3	ERT-3A	ERT-5	ERT12
Aluminum	<200	628	<200	<200	<200	<200	<200	5,700
Chromium	<10	<10	<10	<10	<10	<10	<10	14
Barium	<100	<100	<100	<100	121	<100	276	<100
Beryllium	<5	<5	<5	<5	<5	<5	<5	<5
Cobalt	<50	<50	<50	<50	<50	<50	<50	<50
Copper	<50	<50	51	51	<50	<50	<50	<50
Iron	<50	81,800*	50,700*	40,200*	43,100*	40,200*	3,530	27,200*
Nickel	<40	<40	<40	<40	<40	<40	<40	<40
Manganese	<10	398	285	11,700	725	563	2,140	7,570
Zinc	<10	1620	704	1,080	136	126	185	89
Boron	-	-	-	-	-	-	-	-
Vanadium	<200	628	<200	<200	<200	<200	<200	<200
Silver	<10	<10	<10	<10	<10	<10	<10	<10
(TASK 2)								
Arsenic	<10	<10	<10	<10	<10	<10	<10	<10
Antimony	<20	<20	<20	<20	<20	<20	<20	<20
Selenium	<2	<2	<2	<2	<2	<2	<2	<2
Thallium	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	<0.2	<0.2	.27	<0.2	.67	0.23	<0.2	<0.2
Tin	<20	<20	<20	<20	<20	<20	<20	<20
Cadmium	<1	<1	2.6	1.0	<1	<1	<1	1.6
Lead	<5	<5	14	39	21	27	<5	24

* - Duplicate analysis was outside QC limits, therefore iron values should be considered approximate.

TABLE 5 (continued)

PRIORITY POLLUTANT
INORGANIC ELEMENTS

	H-1	ERT-13	Leed Well	Dadio Well	ERT-3 dupl.	ERT-7	Whitney S. Well	Himmel Well	Tech Well
(TASK 1)									
Aluminum	4,090	53,600	<200	<200	120	<200	<200	<200	<200
Chromium	<10	115	<10	<10	<10	<10	<10	<10	<10
Barium	112	1,160	119	<100	<100	<100	<100	<100	<100
Beryllium	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cobalt	<50	<50	<50	<50	<50	<50	<50	<50	<50
Copper	<50	185	<50	<50	<50	<50	<50	<50	77
Iron	7,050	48,100*	<50	<50	24,500*	56,200*	<50	<50	<50
Nickel	<40	52	<40	<40	<40	<40	<40	<40	<40
Manganese	227	374	133	<10	644	242	<10	14	14
Zinc	40	1490	<10	81	144	366	<10	<10	<10
Boron	-	-	-	-	-	-	-	-	-
Vanadium	<200	<200	<200	<200	<200	<200	<200	<200	<200
Silver	<10	<10	<10	<10	<10	<10	<10	<10	<10
(TASK 2)									
Arsenic	<10	80	<10	<10	<10	<10	<10	<10	<10
Antimony	<20	<20	<20	<20	<20	<20	<20	<20	<20
Selenium	3.9	3.7	<2	<2	<2	<2	<2	2.0	2.0
Thallium	<10	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	<0.2	2.8	<0.2	<0.2	0.67	.22	<0.2	<0.2	<0.2
Tin	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cadmium	<1	15	<1	<1	<1	<1	<1	<1	<1
Lead	11	1,860	<5	<5	<5	12	<5	<5	<5

TABLE 6

Volatile Organic Priority Pollutant Analyses of On and Off-Site Surface Water Samples Collected During the NUS Site Inspection of the Olin Site Inspection on May 15 and 16, 1984.

Contaminant	Stream before Pond A	Stream before bridge on Putnam Ave.	Pond A	Pond B*	Pond C	Pond D*	Lake Whitney (near Treadwell Street)	Himmel Pit
chloroform	21	ND	ND	-	ND	-	-	ND
methylene chloride	ND	ND	ND	-	ND	-	-	6.2**

concentration in ppb

* - data was rejected because the holding time was exceeded

** - data is approximate due to surrogate recoveries slightly out of QC limits.

TABLE 7

Extractable Organic Priority Pollutant Analyses of On and Off-Site Surface Water Samples Collected During the NUS Site Inspection of the Olin Site Inspection on May 15 and 16, 1984.

Contaminant	Stream before Pond A	Stream before bridge on Putnam Ave.	Pond A	Pond B*	Pond C	Pond D*	Lake Whitney (near Treadwell Street)	Himmel Pit
di-n-octyl phthalate	ND	ND	ND	ND	ND	ND	ND	28

(concentration in ppb)

TABLE 8

PRIORITY POLLUTANT INORGANIC ANALYSES OF ON AND OFF-SITE SURFACE WATER COLLECTED DURING THE NUS SITE INSPECTION OF THE OLIN SITE
(May 15 and 16, 1984)

PRIORITY POLLUTANT INORGANIC ELEMENTS Concentration in ppb	Stream before Pond A	Stream before Putnam	Pond A	Pond B	Pond C	Pond D	Lake Whitney Treadwell	Himmel Pit
(TASK 1)								
Aluminum	<200	<200	1390	581				
Chromium	<10	<10	16	<10	<10	<10	<10	<10
Barium	<100	<100	248	<100	<100	<100	<100	<100
Beryllium	<5	<5	<5	<5	<5	<5	<5	<5
Cobalt	<50	<50	<50	<50	<50	<50	<50	<50
Copper	<50	<50	<50	<50	<50	<50	<50	68
Iron	213*	649*	14,000*	1,770*	980*	308	291	346
Nickel	<40	<40	<40	<40	<40	<40	<40	<40
Manganese	18	66	2,300	422	171	95	101	38
Zinc	17	22	1,280	57	28	<10	<10	39
Boron	-	-	-	-	-	-	-	-
Vanadium	<200	<200	<200	<200	<200	<200	<200	<200
Silver	<10	<10	<10	<10	<10	<10	<10	<10
(TASK 2)								
Arsenic	<10	<10	<10	<10	<10	<10	<10	<10
Antimony	<20	<20	<20	<20	<20	<20	<20	<20
Selenium	<2	<2	<2	<2	<2	<2	<2	<2
Thallium	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	1.4	<0.2	<0.2	<0.2	<0.2	<0,2	<0.2	<0.2
Tin	<20	<20	<20	<20	<20	<20	<20	<20
Cadmium	<1	<1	3.6	<1	<1	<1	<1	<1
Lead	<5	8.3	182	58	22	6.4	6.1	10

* - Duplicate analysis was outside QC limits, therefore iron values should be considered approximate.

TABLE 9

Volatile Organic Priority Pollutant Analyses of
Soil Samples Obtained from Former Disposal Areas on
the Olin Site during the Site Inspection on May 15 and 16, 1984.

Contaminant	S-1 near Well 3	S-3 near Pond C	S-1 Duplicate	Soil Blank
trichloroethylene	ND	9.0*	ND	ND

* - levels are approximate due to surrogate recoveries slightly outside of QC limits.

TABLE 10

Extractable Organic Priority Pollutant Analyses of
Soil Samples Obtained from Former Disposal Areas on
the Olin Site during the Site Inspection on May 15 and 16, 1984.

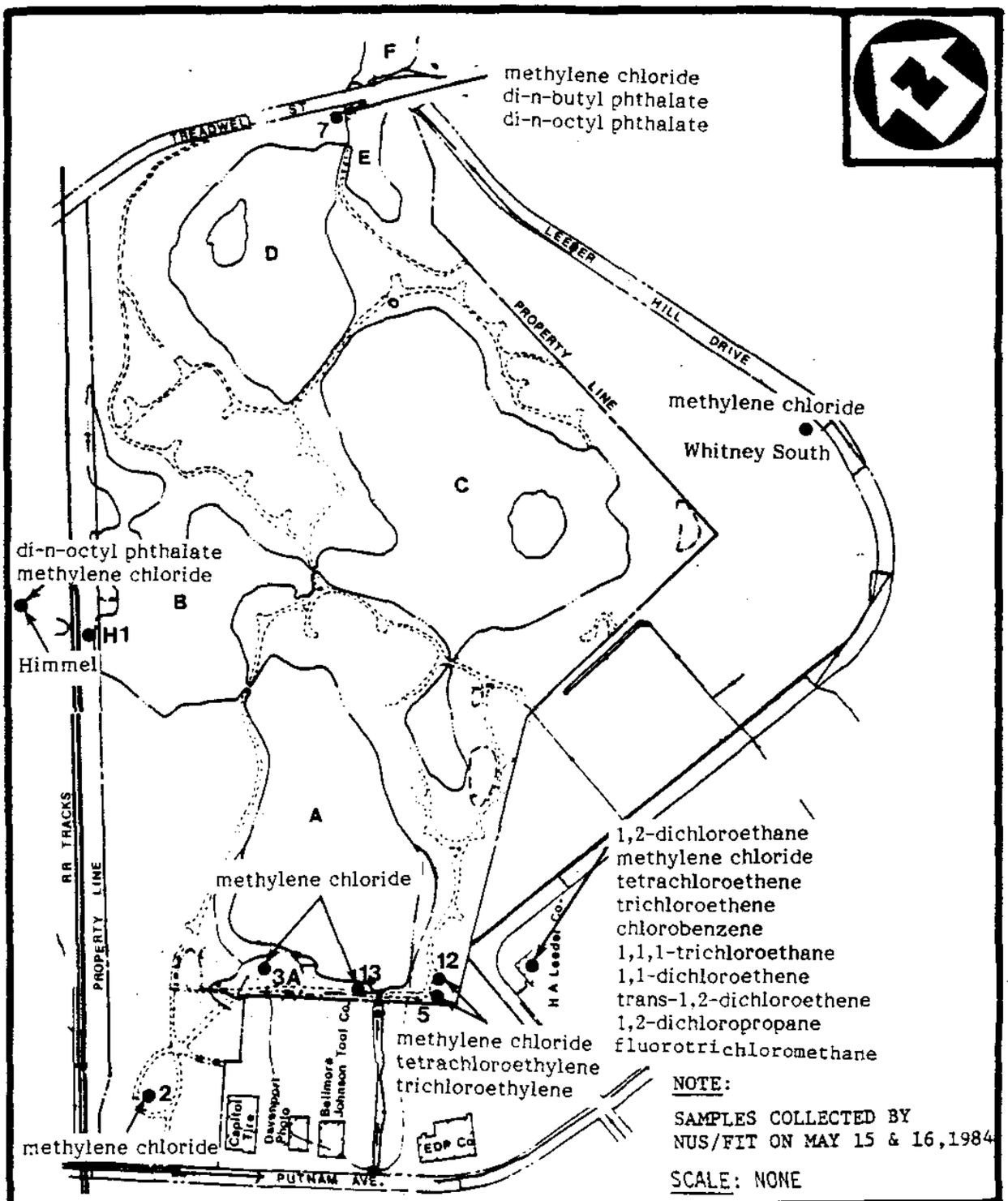
Contaminant	S-1 near Well 3	S-3 near Pond C	S-1 Duplicate	Soil Blank
di-n-butyl phthalate	2,000*	ND	1,800*	ND
fluoranthene	ND	1,400	ND	ND
bis(2-ethylhexyl) phthalate	ND	910	ND	ND
benzo(a)anthracene	ND	710	450*	ND
chrysene	ND	820	460*	ND
phenanthrene	ND	1,200	ND	ND
pyrene	ND	1,400	840*	ND
N-nitrosodiphenylamine	ND	ND	520*	ND
flourene	ND	ND	620*	ND

* - Blind duplicate analyses was outside QC limits because of poor agreement between duplicate samples. As a result, the concentrations of these compounds should be considered approximate.

TABLE 11
PRIORITY POLLUTANT INORGANIC ANALYSES OF SOIL SAMPLES OBTAINED FROM FORMER DISPOSAL AREAS ON THE OLIN SITE DURING THE NUS SITE INSPECTION
(May 15 and 16, 1984)

PRIORITY POLLUTANT INORGANIC ELEMENTS				
Concentration in ppm	S-1 near ERT-3	S-3 near Pond C	S-1 duplicate	Soil blank
(TASK 1)				
Aluminum	5,260	5,560	5,180	7,060
Chromium	10	21	12	12
Barium	64	254	63	50
Beryllium	0.31	<0.2	0.32	0.34
Cobalt	6.2	5.8	6.2	7.0
Copper	174	2,130	186	18
Iron	8,590*	10,400*	10,500*	22,300*
Nickel	20	75	22	15
Manganese	14,700*	795	14,200	510
Zinc	4,740	1,100	5,680	50
Boron	-	-	-	-
Vanadium	21	21	20	<10
Silver	<0.5	4.0	<0.5	<0.5
(TASK 2)				
Arsenic	13*	14*	14*	20*
Antimony	<1	<1	<1	<1
Selenium	<0.1	<0.1	<0.1	<0.1
Thallium	<0.5	<0.5	<0.5	<0.5
Mercury	2.3*	1.4*	3.5*	<0.1*
Tin	<1	4.2	<1	1.1
Cadmium	2.4*	1.8*	2.9*	0.55*
Lead	204*	1,580*	163*	13*

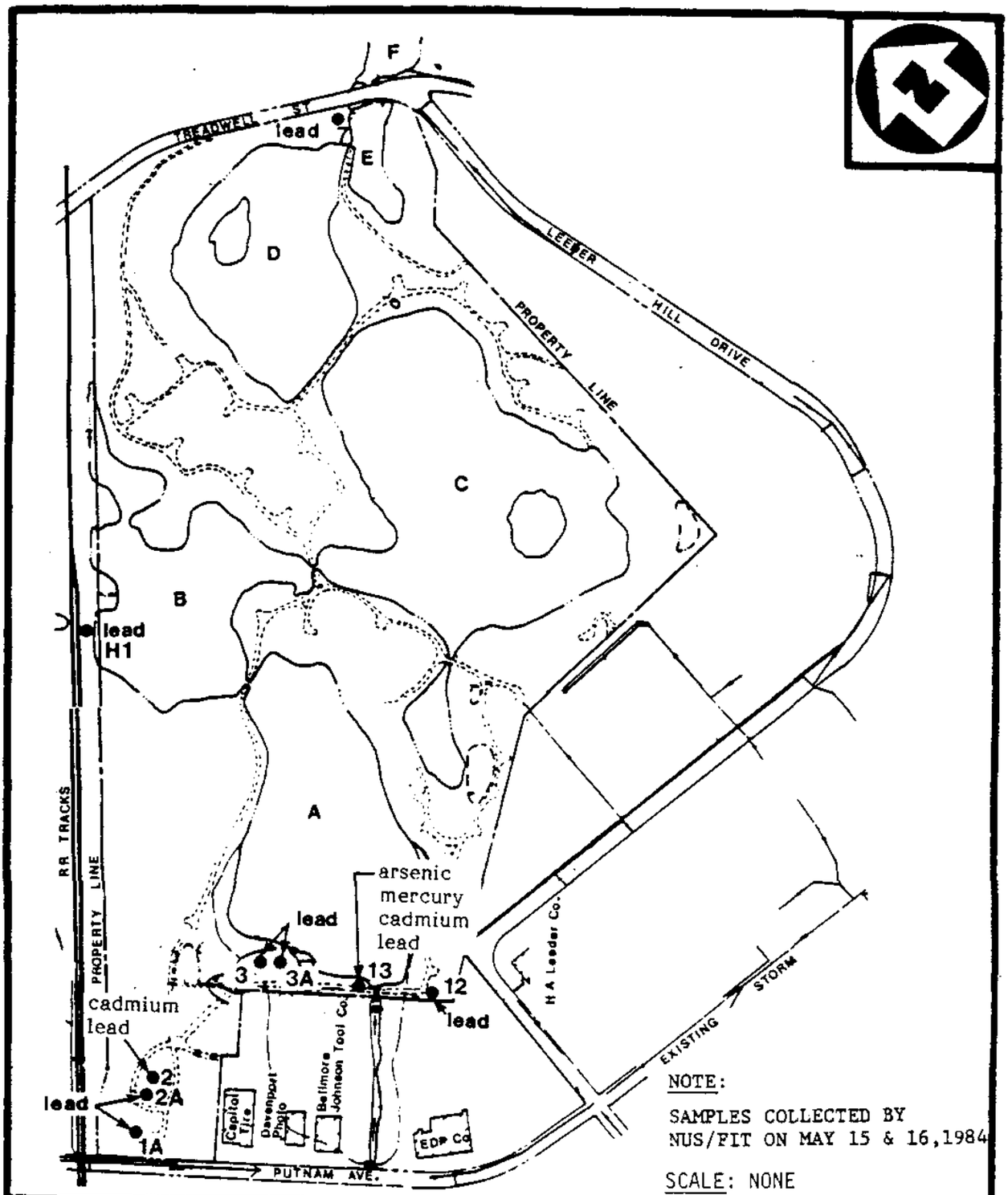
* - Duplicate analysis was outside QC limits, therefore values should be considered approximate.



ORGANIC PRIORITY POLLUTANTS
DETECTED IN GROUNDWATER SAMPLES
OLIN SITE
HAMDEN, CONNECTICUT
AUGUST 1984

NUS CORPORATION
A Halliburton Company

FIGURE 7

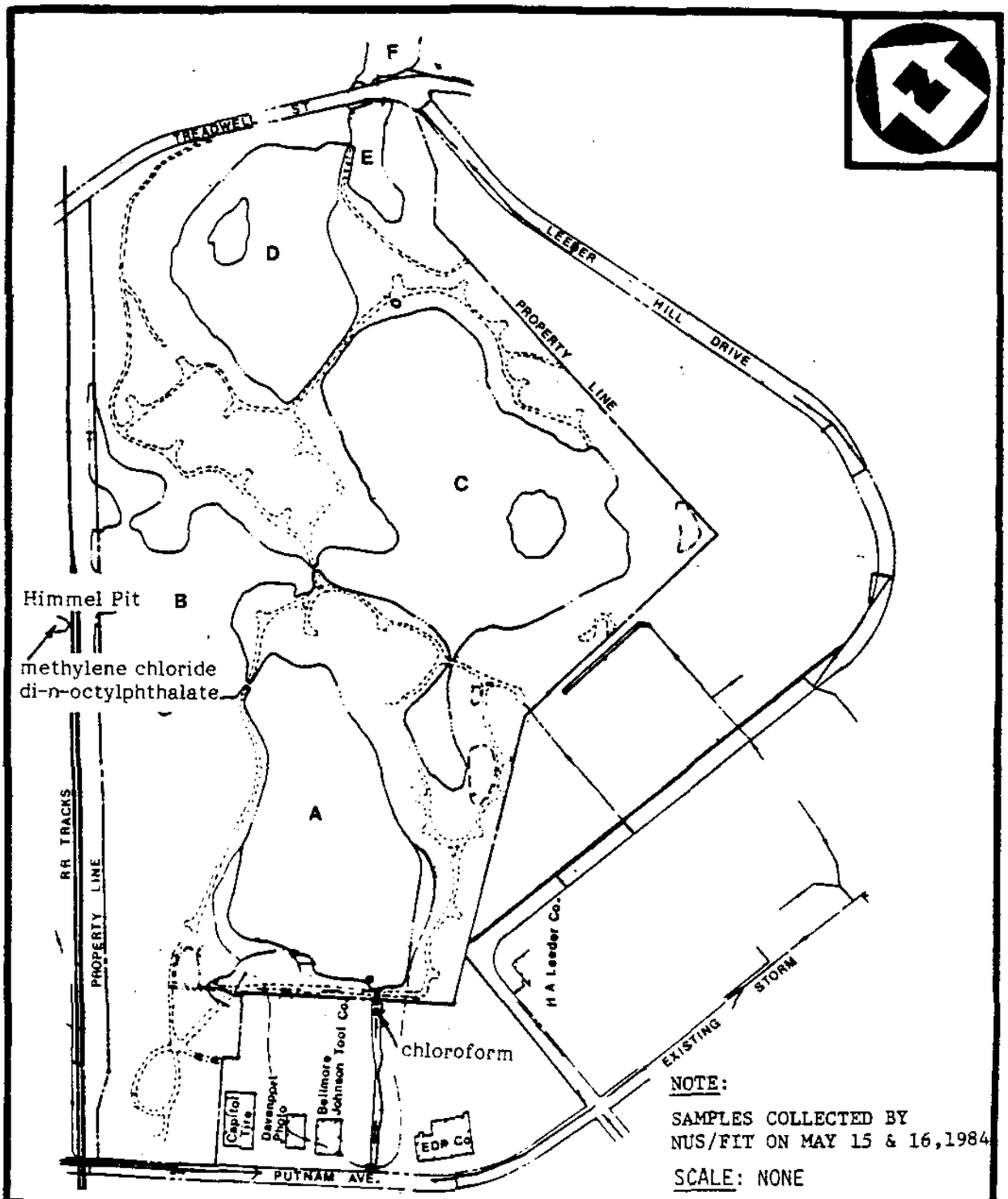


HEAVY METAL CONTAMINANTS DETECTED IN GROUNDWATER SAMPLES OLIN SITE HAMDEN, CONNECTICUT

AUGUST 1984

NUS CORPORATION
A Halliburton Company

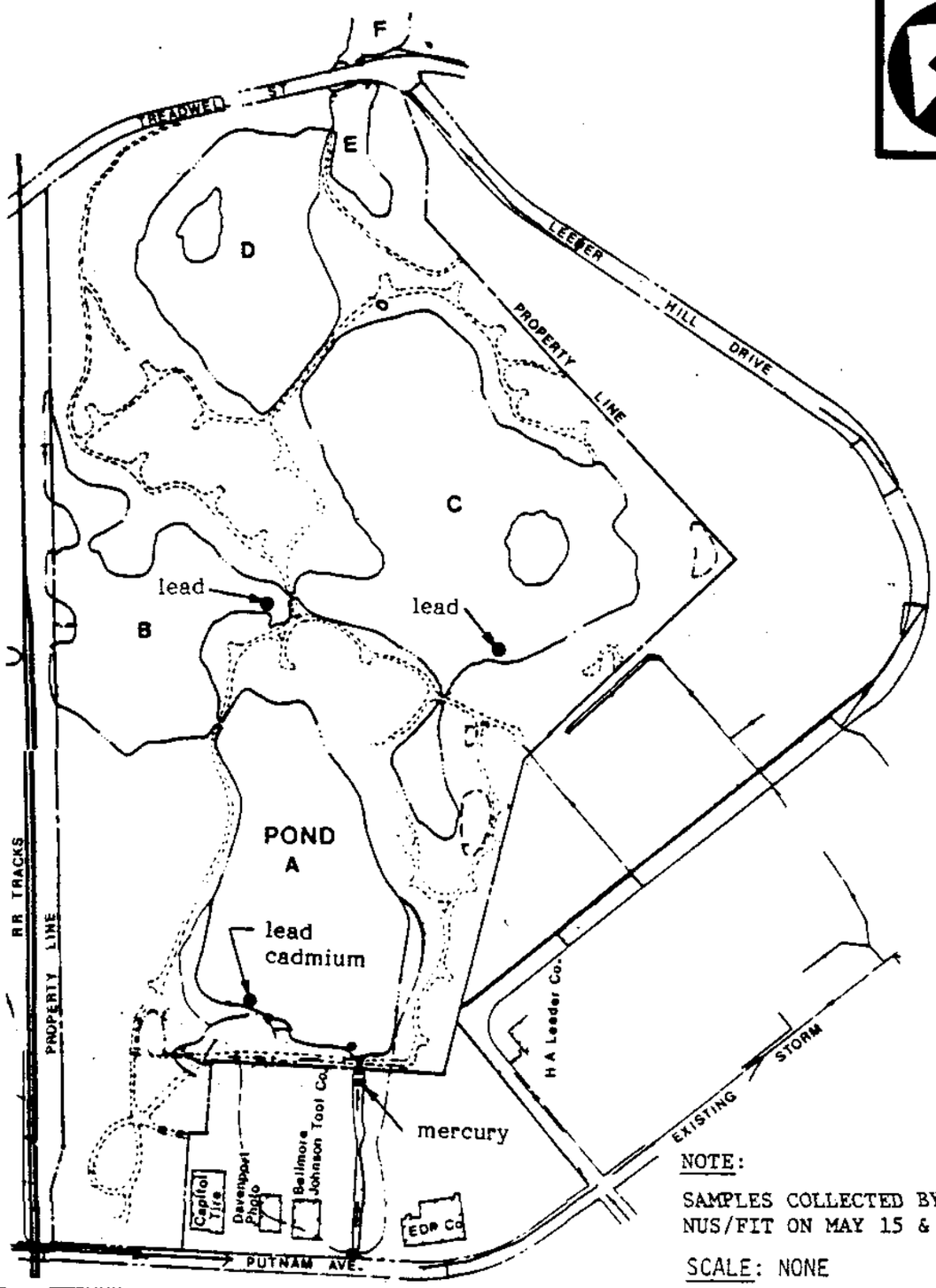
FIGURE 8



ORGANIC PRIORITY POLLUTANTS
DETECTED IN SURFACE WATER SAMPLES
OLIN SITE
HAMDEN, CONNECTICUT
AUGUST 1984

NUS CORPORATION
A Halliburton Company

FIGURE 9



HEAVY METAL CONTAMINANTS
DETECTED IN SURFACE WATER SAMPLES
OLIN SITE
HAMDEN, CONNECTICUT
AUGUST 1984

NUS CORPORATION
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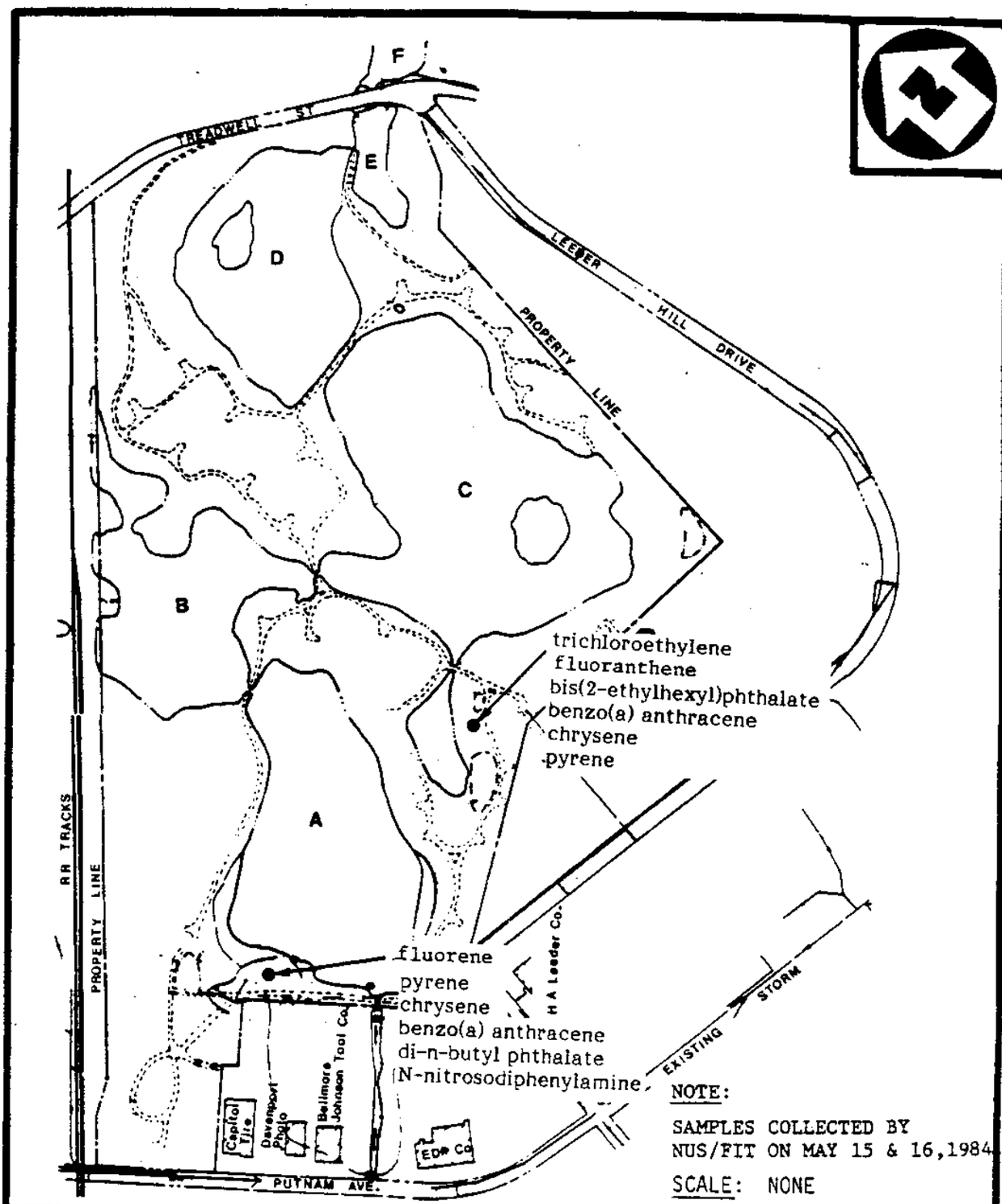
FIGURE 10



ORGANIC PRIORITY POLLUTANTS
DETECTED IN SOIL SAMPLES

OLIN SITE
HAMDEN, CONNECTICUT

AUGUST 1984

NUS CORPORATION
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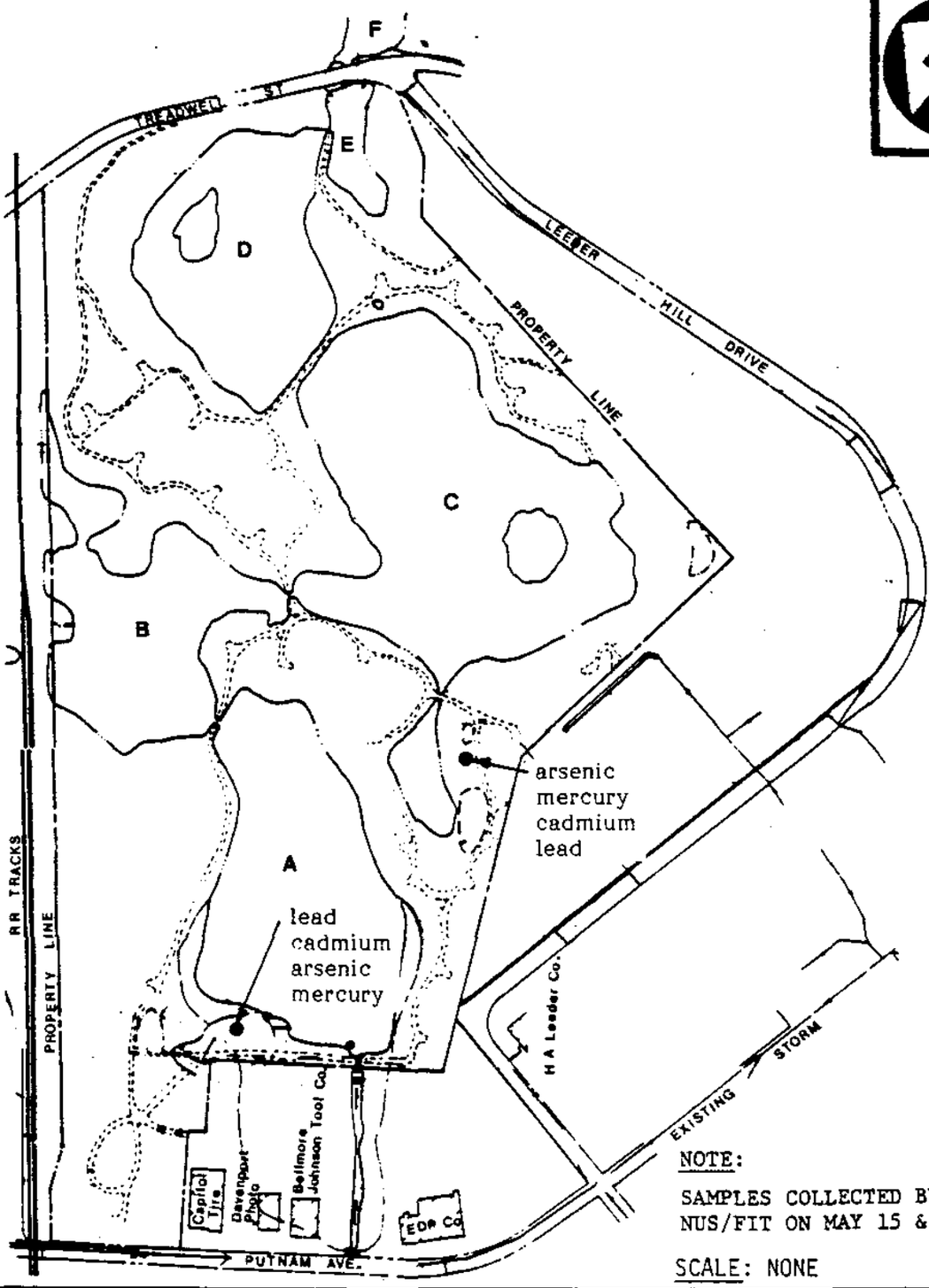
FIGURE 11



HEAVY METAL CONTAMINANTS
DETECTED IN SOIL SAMPLES

OLIN SITE
HAMDEN, CONNECTICUT
AUGUST 1984

NUS CORPORATION
A Halliburton Company

FIGURE 12

of the samples collected by NUS essentially confirm previous findings. Volatile organic contamination was detected in the H.A. Leed well and mainly in ERT wells 5 and 12 (which are directly downgradient of the H.A. Leed well), while extractable organic contaminants were detected in the Himmel well, ERT well No. 7 (near Lake Whitney) and the soil near ERT well No. 3 and near the lower portion of Pond C. Inorganic analyses of all samples indicted concentrations of lead significantly above detection limits mainly in ERT well No 13 (1,860 ppb), Pond A (182 ppb), and in soil samples from near ERT well No. 3 (204 ppm) and near the lower portion of Pond C (1,580 ppm). Arsenic (80 ppb), cadmium (15 ppb), and mercury (2.8 ppb) were also detected in ERT-13 while lead (14 ppb) and cadmium (2.6 ppb) were detected in well ERT-2. The soil near ERT-3 also contained levels of zinc (4,740 ppm) and manganese (14,700 ppm) significantly above detection limits while the soil near the lower portion of Pond C contained levels of zinc (1,100 ppm) and copper (2,130 ppm) significantly above detection limits. The soil samples from both sites also contained arsenic (14 ppm), cadmium (1.8-2.9 ppm), and mercury (1.4-3.5 ppm).

6.0 CONCLUSIONS AND RECOMMENDATIONS

Analytical results of groundwater, surface water and soil samples provide evidence that categories of contaminants (volatile organic, extractable organic and inorganics) are concentrated in specific areas on and off the site. Volatile organic compounds (6-230 ppb) appear to be present in the groundwater near the southeast corner of the site and these contaminants possibly originate from an off-site source near the H.A. Leed Company or the Anixter Company. Extractable organic compounds were detected in the soil near ERT well No. 3 (2,000 ppb) and near the lower end of Pond C (450-1,800 ppb). Lead was the only heavy metal detected (samples were not filtered) at significant levels in groundwater (at ERT well No. 13, 1,860 ppb) and in soil (near the lower end of Pond C, 1,580 ppm). Copper (2,130 ppm) and zinc (1,100 ppm) levels were significantly above detection limits in the soil near the lower portion of Pond C while zinc (5,680 ppm) and manganese (14,700 ppm) were significantly above detection limits in the soil near ERT well No. 3.

Results from a surface water sample from Pond D, a groundwater sample from ERT well No. 7 and a surface water sample from Lake Whitney are a possible indication of what contaminants are leaving the site.

In ERT well no. 7, volatile organic analyses indicates that methylene chloride is present at a low concentration (8.7 ppb). Extractable organic analysis indicates that di-n-butyl phthalate (110 ppb) and di-n-octyl phthalate (640 ppb) were detected with only di-n-butyl phthalate being detected on site while di-n-octyl phthalate was only detected in the Himmel pit (21 ppb) and Himmel well (28 ppb) which are both off site. Inorganic analyses (samples were not filtered) indicates that iron levels (56,200 ppb) and lead levels are slightly above detection limits in ERT well No. 7. Analyses of surface water from Pond D and Lake Whitney indicate no significant levels of organic or inorganic priority pollutants.

Groundwater leaving the site at ERT well No. 7 contains some evidence of contaminants leaving the site and these contaminants are methylene chloride (8.7 ppb), di-n-butyl phthalate (110 ppb), di-n-octyl phthalate (640 ppb) and lead (12 ppb). Of these compounds, only di-n-octyl phthalate is detected exclusively off

site at the Himmel Brothers well and pit. Di-n-butyl phthalates (2,000 ppb) and lead (163-1,580 ppm) were detected in on-site soil while trichloroethylene (9.0 ppb) was only detected at slightly above detection limits.

Analyses of soil samples from the former disposal areas indicate that lead and many extractable organic contaminants are present. Lead levels appear to be only slightly above detection limits near ERT well No. 3 (204 ppm) and significantly above detection limits in the soil near the lower end of Pond C (1,580 ppm). Di-n-butyl phthalate, one of the extractable organic contaminants detected leaving the site in the groundwater was detected in the soil near ERT well No. 3 (2,000 ppb). The soil near the lower end of Pond C contained many extractable organic contaminants.

All information obtained from state and local files indicates that Olin was the sole source of waste at this site and on adjacent property that they formerly owned.

The NUS Region I FIT recommends the following actions:

- Installation of borings or monitoring wells upgradient of the H.A. Leed well to determine the source of the volatile organic contaminants.

- Quarterly sampling and priority pollutant analysis on groundwater from ERT well No. 7 and Pond D to indicate whether contaminants are migrating off-site.

- Further investigation of the area on the Anixter property where excavation took place in April to determine if contamination is present and if so, to find its extent.

- Additional soil sampling should be considered in order to further define the extent of contamination and possible soil removal from the contaminated areas should be evaluated.

7.0 REFERENCES

1. U.S. Geological Survey. Topographical Map of New Haven Quadrangle, 7.5 minute series (photorevised 1972).

2. Panaro, John M. and Palermo, Robert S. (NUS). April 6, 1984. Site visit of Olin site.

3. Flint, Richard F. The Surficial Geology of the New Haven and Woodmont Quadrangle. Connecticut Geological and Natural History Survey Quadrangle Report No. 18. 1965.

4. Recny, Christopher J. Map Showing Unconsolidated Materials, New Haven and Woodmont Quadrangles, Connecticut. U.S. Geological Survey MF 557 D. 1976.

5. Schmidt, Fred and Muzyka, John. Personal communication with Barbara Buckley (ERT) January 1980.

6. Panaro, John M. (NUS) and Palermo, Robert S., Fitzgerald, Lawrence J., and Ross, Robert J. (NUS). May 15 and 16, 1984. Site Inspection of the Olin site.

7. Panaro, John M (NUS) and Grabarek, Robert (New Haven Water Co.). April 3, 1984. "Offsite information inquiry." Telecon.

8. Uncontrolled Hazardous Waste Site Ranking System - A User's Manual. June 10, 1982.

9. United States Geological Survey. Water Resources Investigation of Connecticut. 1978.

10. Panaro, John M. (NUS) and Hughes, John (National Climatic Data Service). June 11, 1984. "Climate inquiry."

11. Ginsberg, Marylyn H. Map Showing Depth to Bedrock, New Haven-Woodmont Quadrangles, Connecticut. U.S. Geological Survey MF-557 C. 197.

12. Site Engineers, Inc. Report on Preliminary Soil and Foundation Investigation Proposed Olin Research Center, Hamden, Connecticut. Prepared for A.M. Kinney, Incorporated. April 1974.

13. The Stephen B. Church Co. Driller's logs and other unpublished data for wells serving Whitney Center. 1977.

14. King's Mark Environmental Review Team Report - Olin Powder Farm, Hamden, Connecticut. August 1979.

15. Meade, Daniel B. Groundwater Availability in Connecticut (map). Connecticut Geological and Natural History Survey. 1978.

16. Mazzaferro, David L., Elinor Handman and Mendall Thomas. Water Resources Inventory of Connecticut, Part 8: Quinnipiac River Basin. Prepared by the U.S. Geological Survey in cooperation with the Connecticut Department of Environmental Protection. Connecticut Water Resources Bulletin No. 27. 1979.

17. Panaro, John M. (NUS) and Duff, Paul (Olin Corp.). June 10, 1984. "Olin Site History." Telecon.

18. Panaro, John M. (NUS) and Valintas, Mary (Hamden Assessors Office). June 20, 1984. "Property History." Telecon.

19. Prota, Vincent (Hamden Health Department). March 17, 1966. "Complaint about burning at Olin." Intraoffice memo to Parente, Dr. Leonard.

20. Roper, Barbara L. (Hamden Health Department Clerk). "Summary of Hearing Regarding Difficulties with Property of Olin Mathieson Chemical Corporation". March 23, 1966.

21. Prota, Vincent (Hamden Health Department). April 7, 1966. "Follow-up inspection of Olin." Intraoffice memo to Parente, Dr. Leonard.

22. Panaro, John M. (NUS) and Duff, Paul (Olin Corp.). June 21, 1984. "Olin Site History." Telecon.

23. Ludwig, Frances (New Haven Water Company). April 7, 1981. "Review of Environmental Investigation of Olin's Pine Swamp." Intraoffice memo to McHugh, Richard P. and Schaefer, Otto E.

24. Curtis, Brian (Senior Sanitary Engineer, Water Compliance Unit, Connecticut Department of Environmental Protection). May 26, 1981. "DEP review of ERT Report I." Letter to Wisely, G.T. (Manager, Environmental Regulatory Compliance, Olin Corporation).

25. Curtis, Brian (Senior Sanitary Engineer, Water Compliance Unit, Connecticut Department of Environmental Protection). September 24, 1981. "DEP's intent to issue an abatement order." Letter to Wisely, G.T. (Manager, Environmental Regulatory Compliance, Olin Corporation).

26. Ludwig, Frances (New Haven Water Company). Octobr 23, 1981. "Olin's proposal for additional hydrologic work." Intraoffice memo to file.

27. Duff, Paul (Manager, Energy and Environmental Affairs). December 1, 1981. "Olin's finalization of the second hydrologic investigation." Letter to Curtis, Brian (Senior Sanitary Engineer, Water Compliance Unit, Connecticut Department of Environmental Protection).

28. Grabarek, Robert (Environmental Engineer, New Haven Water Company). December 30, 1981. "Summary of activities during ERT's second investigation." *Intraoffice memo to file.*

29. Tucker, Dr. Jesse (Director, Connecticut Department of Health Services Laboratory Division). September 7, 1982. "Laboratory analysis of soil samples." *Letter report to Harrison E.* (Senior Environmental Analyst, Connecticut Department of Environmental Protection).

30. Environmental Research & Technology, Inc. Report for the Phase II Site Investigation at Pine Swamp, Hamden, Connecticut, Olin Corporation. June 1982.

31. Panaro, John M. (NUS) and Mason, Dick (Connecticut Water Compliance Section). June 28, 1984. "Abatement Order to Anixter." Telecon.

32. Environmental Research & Technology, Inc. Report for the Phase I Site Investigation at Pine Swamp, Hamden, Connecticut, Olin Corporation. January 1981.

33. Curtis, Brian (Senior Sanitary Engineer, Water Compliance Unit, Connecticut Department of Environmental Protection). April 11, 1983. "DEP's intent to restore Pine Swamp area groundwater." Letter to Duff, Paul (Manager, Energy and Environmental Affairs, Olin Corporation).